OPEN REDUCTION OF INFANTILE DISPLACEMENT OF THE HIP IN CHILDREN UNDER TWELVE MONTHS OF AGE: WHEN, WHY, HOW

JOHN R. DENTON, M.D.
Chief, Pediatric Orthopaedic Service
Department of Orthopaedics
Columbia-Presbyterian Medical Center
New York, New York

Approximately 85% of children with infantile displacement of the hip, whether subluxation or frank dislocation, can be managed by closed means. The 15% who cannot be managed this way are the subject of this presentation. Only the *common* variety of infantile displacement of the hip will be considered, and children with teratologic or neuromuscular diseases are excluded.

The general indication for an open reduction is failure to obtain and/or maintain concentric reduction by closed means. Failure to obtain a closed reduction is usually caused by an inverted limbus, an hourglass capsule, or the presence of fibrofatty tissue in the acetabulum.

General principles of management include examination under anesthesia, *open* abductor and psoas release, arthrogram, prereduction traction (10 to 14 days), and open reduction. A great deal of information may be gained by examining the hip under general anesthesia using an image intensifier. If there is any adductor tightness, *open* adductor release is performed. This includes the adductor longus, usually the adductor brevis, and perhaps part of the gracilis and part of the adductor magnus. The iliopsoas tendon should also be released at this time. These releases can be done through a transverse incision two to three centimeters long in the adductor area. I do not feel that an adequate release can be done by the so-called "percutaneous method." If the hip is still too tight and high-riding, the procedure is terminated and the child is placed in skin traction until the hip is pulled down to the proper station.

Address for reprint requests: 161 Fort Washington Ave., New York, N.Y. 10032

In children less than 12 months of age, the conditions previously listed as causes for failure of reduction are difficult to diagnose from plain radiographs because of incomplete ossification of the femoral head and margin of the acetabulum. An arthrogram of the hip is very useful in defining the reason for inability to obtain a closed reduction. We prefer to perform the arthrogram in the operating room with the child under general anesthesia. An image intensifier is used for needle placement from either the anterior or medial aspects, and to observe the hip when the dye, a 30% contrast solution, is in place.

Prevention of iatrogenic avascular necrosis of the femoral head must always be borne in mind. The benefits of preoperative traction have been well demonstrated by Gage and Winter.[1] In children less than 12 months of age, skin traction is usually adequate. For this purpose we prefer the use of a Bradford frame, shown in Figure 1. The child may be taken out of the frame for feeding and bathing. Care must be taken in skin traction to avoid skin or neurovascular compromise to the leg. An infant cannot tell us if his wrappings are too tight or uncomfortable. After a coating of tincture of benzoin to the skin, two inch stockinette is applied from midthigh to toes and the Buck's track is then applied. Enough weight should be applied to just lift the child's sacrum off the horizontal support. Traction in this age group is very efficient, and the maximum result is gained in 10 to 21 days. Our usual period of traction is 14 days, and 21 days is the longest period that a child needs to be in traction.

Failure to maintain an adequate reduction is usually caused by a lax capsule, the presence of fibrofatty tissue in the acetabulum, or the extreme position of the hip necessary to maintain a reduction. A large redundant capsule may not hold the femoral head in place even in a spica cast. Therefore, at open reduction, a capsulorrhaphy is done to tighten the anterior capsule. Fibrofatty tissue in the depths of the acetabulum will also prevent the head from concentric reduction, and the head is liable to displacement. At one time it was taught that even if fibrofatty tissue were interposed, as long as the femoral neck was pointing into the acetabulum this tissue would eventually atrophy and the head would seat itself. It is now believed that this is not the usual sequence of events, and that the head will not stabilize in the acetabulum unless concentrically reduced without interposed tissue.[2] If there is any question about the head's being concentrically reduced either at the time of reduction or later in the cast, an arthrogram should be done to establish this definitely.

Avascular necrosis of the femoral head may be caused by excessive joint

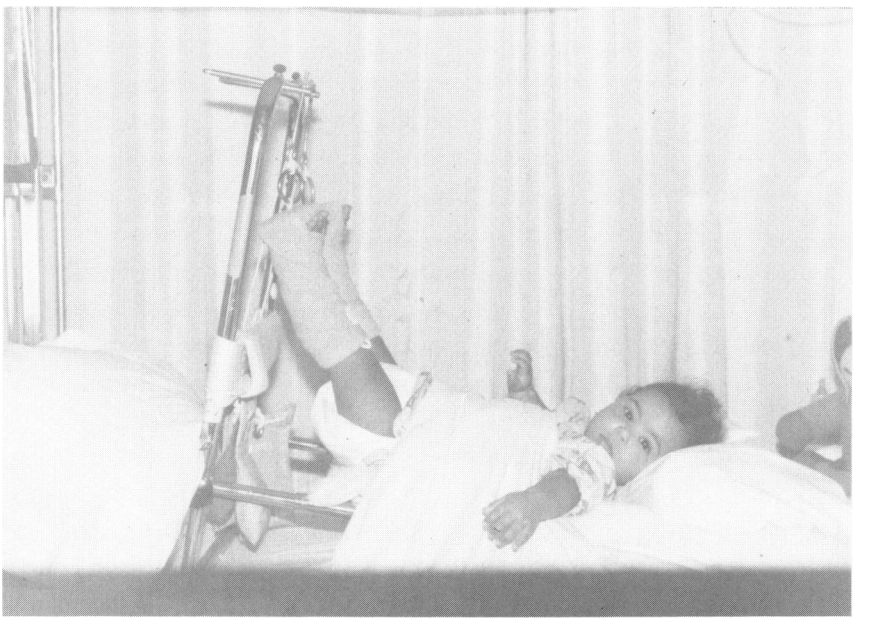

Fig. 1. Child in traction on a Bradford frame

reaction force, by tight adductors and iliopsoas, or by extreme positions of the hip. The Lorenz position strongly abducts the hip, which puts pressure on the lateral epiphyseal vessels, thereby damaging the head. A position of extreme internal rotation, the Lange position, stretches the vessels, also causing avascular necrosis. Either of these extreme positions is contraindicated. The "human position" espoused by Salter is the position of stability after a *closed* reduction. This is a position of 90 degrees of flexion, no more than 45 degrees of abduction and some internal rotation. Placing the hip in 90 degrees of flexion after open reduction may sometimes lead to flexion deformity. Instead, after open reduction, the hip should be placed in no more than 30 degrees of flexion, 30 degrees of abduction, and not an excessive amount of rotation. Capsulorrhaphy performed at open reduction is usually tight enough that the hip does not need to be placed in more than 30 degrees of flexion.

After the decision to perform an open reduction has been made, the next decision is whether to use the iliofemoral or the medial aproach.[3,4,5] I favor the former. The iliofemoral approach permits capsulorrhaphy and provides the easiest access to the superior structures of the acetabulum, acetabular contents, and anaterior capsule. Although it is not usually

necessary in children less than a year old, acetabular or femoral procedures can also be done. A bikini incision cannot be used in making the iliofemoral approach, which provides less access to the psoas and the inferior structures than does the medial approach. Nevertheless, these limited advantages of the medial approach are offset by its disadvantages: capsulorrhaphy is not possible; no lesion of the limbus or superior structures can be corrected; no femoral or acetabular and fewer intracetabular procedures are possible. In addition, some authors have found a higher incidence of avascular necrosis after the medial approach.[3] This is probably because vessels to the femoral head course very closely to the lesser trochanter and inferior medial capsule, and are easily injured in this approach, which has a great deal of "blunt dissection." It is probably fair to say that a child six months or younger with a displaced hip is a *better* candidate for the medial approach than an older child, but we still prefer the iliofemoral approach for patients of all ages.

Illustrative Cases

Case I is an example of the efficacy of an arthrogram. This boy was noted to have displacement of his left hip at birth (Figure 2), and was treated in a Pavlik harness beginning in the neonatal period. Monitoring of parental compliance in our clinic indicated that the harness was worn as prescribed. However, after three months the left hip was still displaced and unstable. The child was taken to the operating room for examination under anesthesia and an arthrogram. On examination the hip did not clinically seat in the acetabulum. The arthrogram (Figure 3) demonstrated that an inverted limbus and an hourglass capsule were blocking reduction of the femoral head. An open adductor tenotomy and iliopsoas release were performed and the child was placed in skin traction for 10 days. He was then taken back to the operating room for an open reduction of the left hip.

At operation the limbus was excised and a wide capsulotomy was done to reduce the head. An enlarged ligamentum teres was also excised. After this was done, a tight anterior capsulorrhaphy was performed. The head was stable at surgery. The child was then placed in a spica cast with the hip in 20 degrees of flexion and mild abduction. Figure 4 shows a tomogram immediately after operation with the left hip in place. He was kept in the spica for a total of three months after surgery. The child was

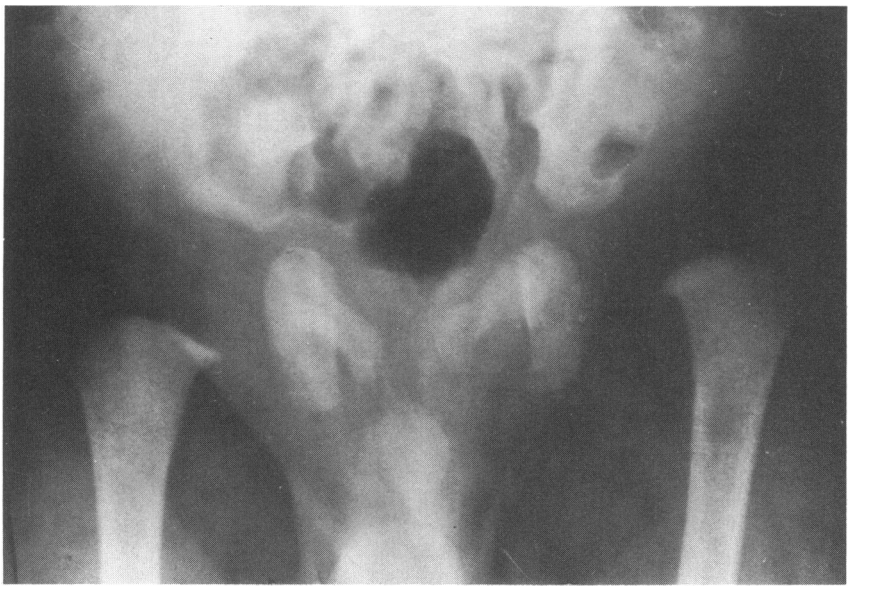

Fig. 2. Radiograph (Case I) illustrating left hip dislocation

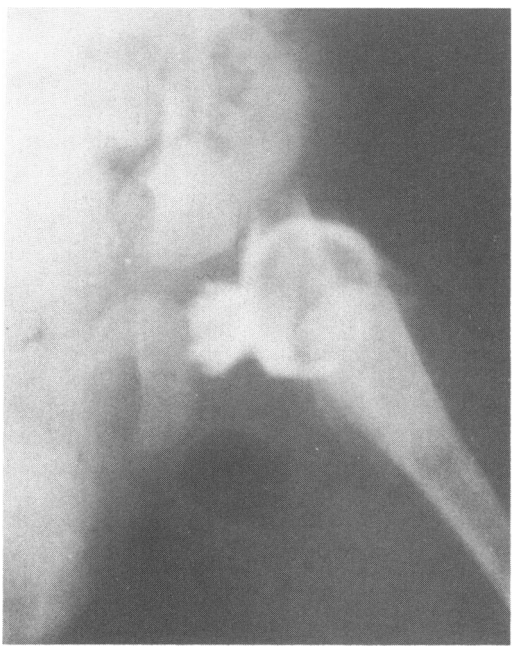

Fig. 3. Arthrogram of same left hip

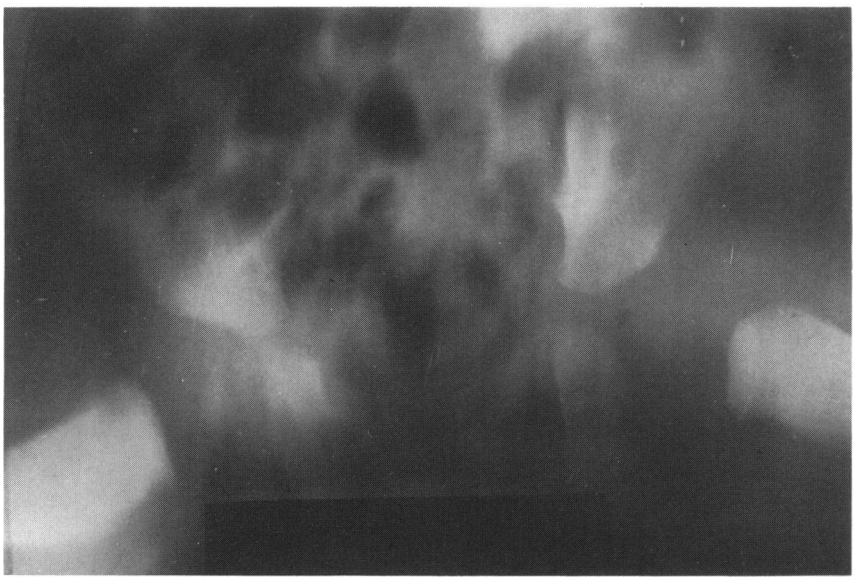

Fig. 4. Tomogram with patient (Case I) in spica cast showing the left hip to be in place. Note (1) that the neck is directed toward the inferior aspect of the acetabulum and (2) that the proximal femur and pelvis are in the same degree of focus

then placed in a Haas bar. Initially this was done for 24 hours a day for three weeks (Figure 5). The child was then weaned out of the bar over the next three months. The femoral head has remained located.

Case II was an infant diagnosed, at the age of three months, as having a right hip displacement. The initial radiograph (Figure 6) showed that the normal left hip had no changes of avascular necrosis. The right hip was laterally displaced. A closed reduction was performed and the patient was in a spica cast for four months. The right hip was still outstanding. An arthrogram (Figure 7) showed that the limbus was in the proper position. However, a large space filled with contrast medium between the floor of the acetabulum and the femoral head indicated the interposition of fibrofatty tissue. This tissue was subsequently removed during open reduction. Note that the *left* hip had metaphyseal changes consistent with avascular necrosis, possibly from an extreme position in the cast.

SUMMARY

Eighty-five percent of children under 12 months old with infantile displacement of the hip can be managed successfully by an abduction

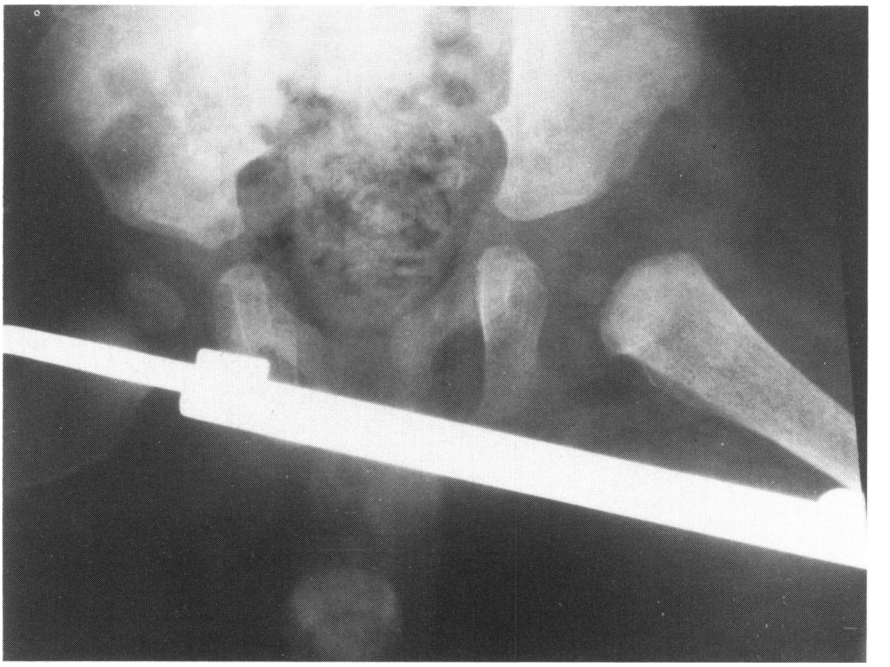

Fig. 5. Radiograph of patient (Case I) in abduction device with left hip located. There are no signs of avascular necrosis

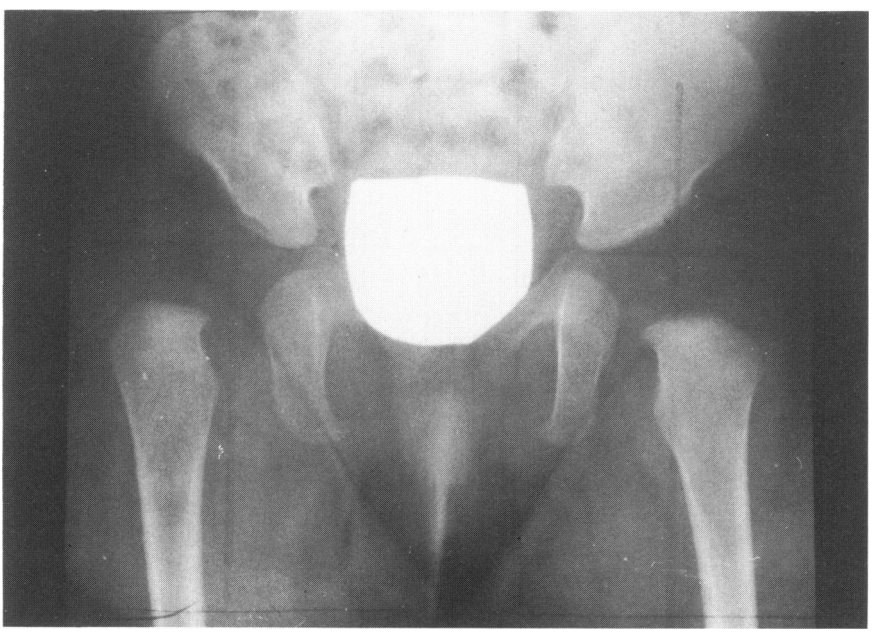

Fig. 6. Radiograph (Case II) demonstrating a lateralized right hip and a normal left hip

Fig. 7. Arthrogram of same patient showing (1) left hip with tissue interposed between head and acetabulum, and (2) changes of avascular necrosis in the "normal" left hip

device such as a Pavlik harness or Von Rosen splint. For those who are older, an abduction device such as a Haas bar or Elfeld splint is adequate. It is the remaining 15% of these patients who are a problem. Our general approach to these patients is: examination under anesthesia; open adductor and psoas release; performance of an arthrogram, if indicated; the use of prereduction traction for 10 to 14 days if the femur is high-riding, and open reduction to correct the pathology.

Care must be taken in open reduction to insure that all fibrofatty tissue at the base of the acetabulum is removed, or concentric reduction of the head will not occur. After operation, the child is kept in a spica cast for three months, then placed in an abduction device such as a Haas bar or Elfeld splint. The device is kept on for 24 hours a day for three weeks, and then the child is weaned out of it over the next three months. Radiographic and clinical monitoring of the hip must be done during this period of weaning.

REFERENCES

1. Gage, J.R. and Winter, R. B.: Avascular necrosis of the capital femoral epiphysis as a complication of closed reduction of congenital dislocation of the hip: a critical review of twenty years' experience at Gillette Children's Hospital. *J. Bone Joint Surg. 54A:* 373-88, 1972.
2. Renshaw, T. S.: Inadequate reduction of congenital dislocation of the hip. *J. Bone Joint Surg. 63A:* 1114–21, 1981.
3. Kalamchi, A., Schmidt, T. L., and MacEwen, G. D.: Congenital dislocation of the hip. Open reduction by the medial approach. *Clin. Orthop. 169:* 127-32, 1982.
4. Roose, P. E., Chingren, G. L., Klaaren, H. E., and Broock, G.: Open reduction for congenital dislocation of the hip using the Ferguson procedure. A review of twenty-six cases. *J. Bone Joint Surg. 61A:* 915–21, 1979.
5. Simons, G. W.: A comparative evaluation of the current methods for open reduction of the congenitally displaced hip. Symposium on the Child's Hip. *Orthop. Clin. North Am. 11:* 161–81, 1980.